

MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

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ANNUAL SUMMARY.

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INTRODUCTION.

The SUMMARY for the year 1896 is based upon data received from about 3,000 stations occupied by regular and voluntary observers of the Weather Bureau, Canadian data received by the cooperation of Prof. R. F. Stupart, and Mexican data received by the cooperation of Dr. M. Bárcena, the Director of the Central Meteorological Observatory of Mexico. The statistical tables have been generally prepared by the Division of Records, and Meteorological Data, A. J. Henry, Chief of Division. The text and editorial work are by Prof. Cleveland Abbe unless otherwise specifically noted.

GENERAL CLIMATIC CONDITIONS.

ATMOSPHERIC PRESSURE.

The mean pressure for 1896 is shown numerically in Tables I and II. The method of reduction to sea level and the omission of the correction for gravity, as explained by Prof. H. A. Hazen in the MONTHLY WEATHER REVIEW for 1894, Vol. XXII, page 538, have continued in use in the Weather Bureau during 1896, and the figures given in Tables I and II, as also those on Chart I, accord therewith. Owing to the variations of gravity with latitude and altitude, the readings of the mercurial barometer, after being corrected for instrumental temperature and index error, need a further correction or reduction to standard gravity in order to represent the true atmospheric pressure, as measured by a uniform standard. As the international conferences of meteorologists have uniformly urged the application of the reduction to standard gravity and the further reduction to sea level by the tables and methods of the International Meteorological Committee, the Editor has requested Mr. Park Morrill to make the corresponding corrections and reductions. The general method of doing this is explained in the MONTHLY WEATHER REVIEW for 1895, Vol. XXIII, pages 492-494; the results for 1896 are shown in the accompanying table and on Chart IV.

These charts cover the stations of the United States and Canada and can easily be extended over Mexico when the annual mean values for stations in that country become available.

As the general motions of the lower atmosphere depend intimately upon those of the upper atmosphere, it is important to study the isobars and temperatures at elevations of 10,000 feet or more. Assuming a general average decrement of temperature at the rate of 2° F. per 1,000 feet (0.37° C. per 100 meters), the reduction upward can easily be made by using Table B, MONTHLY WEATHER REVIEW, for 1895, page 494, as computed by Mr. Morrill. By a slight change in the first column, which gives the temperature argument, this table becomes applicable to reduction upward to 10,000 feet for any rate of diminution of temperature with altitude and is reprinted as Table F of the present SUMMARY. The resulting isobars are shown on Chart V. On the other hand, with any adopted rate of diminution of temperature, pressures may

be reduced upward to the level of 5,000 meters, or 16,404 feet, by means of the table on page 419 of the MONTHLY WEATHER REVIEW for November, 1896, as computed by Koeppen.

The data on Chart I show that the reduced barometric means not corrected for gravity were highest in the east Gulf and South Atlantic States and lowest in southern Arizona, but nearly as low in Newfoundland.

The data on Charts IV and V show that the true pressure gradients at sea level differ appreciably from the apparent pressure gradients on Chart I. They also show that the high-level gradients are steeper and that, therefore, the currents of air are swifter than at sea level. Both the high-level and sea-level gradients and winds and temperatures represent the result of the interaction of ascending and descending currents. If there were no such vertical interchange of air the contrasts between the upper and lower systems would be still stronger. The resultant surface winds are shown on Chart I, and should be compared with both the sea-level and the upper-level isobars. It is very desirable that the wind currents at the 10,000-foot level should be brought under observation in order to compare these directly with the isobars. The observations of cloud motions are only approximately satisfactory, and the true wind directions obtained by kites or free balloons are preferable.

AREAS OF HIGH AND LOW PRESSURE FOR 1896.

The location of an area of high or low pressure is, to a limited extent, affected by the method adopted in the reduction of the barometer to sea level. The following summary, therefore, holds good, especially in connection with the method adopted by the Weather Bureau for the past few years. The average daily and hourly movements of the centers of the areas are given by paths and by days in the individual tables of the successive MONTHLY WEATHER REVIEWS, and the monthly sums are collected together in the following table for the purpose of taking the annual means by paths and by days.

These averages show the same peculiarity as do those for the year 1895, namely that the means taken by days are in both cases smaller than those by paths; that is to say, when each path is given the same weight, no matter whether it is